IRON-TYPE GOLF CLUB HEAD WITH SOLE HAVING STABLE STATIC ADDRESS POSITION

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This U.S. utility patent application claims the benefit of U.S. provisional patent application Serial No. 60/437,047, filed December 31, 2002, the entire disclosure of which is incorporated by reference herein.

BACKGROUND

[0002] The present invention relates to the design of golf clubs, and more particularly to designs to provide golf club heads of iron-type golf clubs improved static stability when oriented in the address position.

[0003] The address position of a golf club usually refers to the orientation of the head of a golf club when a player is holding the grip and shaft of the club in a substantially vertical plane with the club head, attached to that shaft, being located just behind a golf ball before hitting same, i.e., "addressing the ball," resting on the ground just behind the golf ball. The sole of a golf club head is the bottom surface(s) thereof, which may rest on the ground when the club head is in an address position.

[0004] As discussed later herein, the sole portion of an iron-type golf club often increases in total width (as measured in the club face-to-back direction) at locations progressing from the heel portion to the toe portion of the sole of the club head. The sole of an iron-type golf club head may be substantially flat, or may be curved from heel to toe (the so-called "radius" of the sole of a club head) and/or curved from leading edge to trailing edge of the sole (the so-called "camber" of the sole of a club head), such curves causing the sole to bulge downwardly in a convex manner.

[0005] The "radius" of the sole of an iron type golf club is preferably symmetrical with respect to the centerline plane of the club head (which plane is discussed later herein). For example, the earlier Hogan Radius irons, and Cleveland 792 VAS irons, are examples of club heads having convex "radius" and "camber" sole curvatures. Additionally, sand wedges often exhibit such sole curvatures.

[0006] Iron-type golf club heads are ideally designed to strike a ball with the face centerline, as shown in Fig. 1, in a centerline plane perpendicular to both the hitting face of the club head, and the ground. However, it is well known to those skilled in the art that during a golf swing the shaft of a golf club bows

outwardly away from the body of the player swinging the club, causing the toe of the club head to droop slightly. To compensate for such toe droop at impact with the ball, the lie angle of a club head with a given shaft should be chosen so that at impact with the ball the centerline plane is perpendicular to both the hitting face and the ground, as shown in Fig. 1. This lie angle of a club is said to be "dynamically-proper." The "lie angle" of a club head is usually said to be the angle, in a vertical plane, between the axis of the hosel portion of the club head and a horizontal plane, measured when the club head is oriented with its centerline plane in a vertical position.

[0007] Herein the "address position" means a position wherein the toe of a club head will be slightly raised, that is pivoted upwardly about the heel, as schematically shown somewhat exaggerated in Fig. 2. In other words, in the address position the contact point of the club head with the ground, called the "static contact point" SCP will be slightly heel-biased (located somewhat toward the heel) from the aforementioned centerline plane. This is in part due to the chosen "dynamically-proper" lie angle.

[0008] Many golf clubs, especially iron-type clubs, also exhibit sole inversion or "bounce" to prevent the clubs from

undesired digging into the turf while hitting a golf ball. In a conventional golf club the bounce angle of a club head in ball striking position is the angle between a line (in the centerline plane, for example) from the leading edge of the club face rearwardly toward the low point of the sole of the club head and a horizontal line (in the same plane), is generally between zero and twenty degrees, and uniform along the entire length of the sole. A "bounce line" is defined by the lowest points of the club head in a plurality of planes perpendicular to the club face. This line is also the lowest line in the face profile view of the club head. When in the address position, a conventional club head is statically unstable, as shown in Fig. 3, because the uniform bounce angle of the sole causes the aforementioned heel-biased static contact point SCP of the club head with the ground to be laterally (in the face-to-back direction) offset a distance D with respect to a vertical line through the center of gravity CG of the club head (i.e., at address the ground contact point of a conventional golf club head is not vertically below the center of gravity of the club head, but is on a line vertically to the rear (or front) thereof, as viewed from the heel looking toward the toe of the club head). Due to this instability, the face of a conventional club head tends

to open or close at address, depending on whether the static ground contact point is on a vertical line forward or rearward of the center of gravity, as indicated in Fig. 3. A golf club having a propensity to open or close at address does not feel balanced to the player, thus undermining the player's confidence in the club. When a club is in the address position, players expect it to feel steady, even when applying only minimal grip pressure, and they also expect the club head to look square to the desired initial line of ball flight.

[0009] Those skilled in the art will appreciate that when hitting a golf ball, a golf club should make initial dynamic contact with the ground at a low point LP on the sole, that lies substantially in the centerline plane as discussed with respect to Fig. 1. This is the low point of the usually symmetrical sole radius. If the club head is not so designed, the accuracy of shots therewith may suffer. For example, initial dynamic contact of the sole with the ground toward the toe causes the club face to open, thereby producing an undesired fade or slice shot. Similarly, initial dynamic contact of the sole with the ground toward the heel causes the club face to close, producing an undesired draw or hook shot. As shown in Fig. 4, even if the lie angle of a conventional

golf club is "dynamically proper," the initial dynamic contact point of the sole with the ground is typically still somewhat undesirably toward the toe because the bounce angle is constant along the entire length of the sole and the width of the sole increases from heel to toe. Fig. 4 shows that the amount of sole surface exposed in a face view of an iron-type club head is greater near the toe portion of the sole (Distance B) than near the heel portion of the sole of the club head (Distance A). Thus, on the downswing, the sole of a conventional club typically will initially contact the ground at a point along the bounce line somewhat toward the toe as indicated in Fig. 5, causing the club face to open and an undesired fade or slice shot to result.

[00010] The ground contact lowest point LP is located slightly toward the toe a distance from the centerline plane of from about .050 inches to about .250 inches among clubs of a set of irons. To eliminate such differences, the lie angle of the club head may be adjusted by about 0.5 to about 1.5 degrees. This slight adjustment in lie angle will cause the centerline plane to be slightly out of perpendicular to a horizontal ground plane, which can result in off-center ball strikes. However, the present invention provides a solution to these problems.

BRIEF SUMMARY OF THE INVENTION

[00011] Hence, a need exists for an iron-type golf club that is stable and feels steady at address, thus increasing the player's confidence in that club. It is also desirable to provide a golf club having a club head which will make initial dynamic contact with the ground at the centerline plane junction with the sole, and preferably vertically below the center of gravity of the club head, thereby minimizing the possibility of club head-induced hook or slice shots. The centerline plane can be maintained perpendicular to the ground plane by modifying sole width, radius, camber and bounce. Before such dynamic ball striking and ground contact, steady address is achieved in the golf club head of the present invention by providing in the sole of the club head a static contact point, line and area preferably vertically below the center of gravity of the club head when in an address position.

BRIEF DESCRIPTION OF THE DRAWINGS

[00012] Other advantages and further features of the advantageous golf club head of the present invention are shown in and described in conjunction with the following drawings:

[00013] Fig. 1 is a partially schematic face view of an iron-type golf club head additionally illustrating certain aspects of the present invention;

[00014] Fig. 2 is a schematic view of an iron-type golf club head additionally schematically illustrating a status contact point when the club head is at address position;

[00015] Fig. 3 is a partially schematic heel view of an iron-type golf club head additionally illustrating certain aspects of the present invention;

[00016] Fig. 4 is another face view like Fig. 1 but illustrating further aspects of the present invention;

[00017] Fig. 5 is a partially schematic sole view of an iron-type golf club head additionally illustrating still further aspects of the present invention;

[00018] Fig. 6 is another sole view like Fig. 5, but illustrating yet further aspects of the present invention; and

[00019] Fig. 7 is still another sole view like each of Figs. 5 and 6, and illustrating even further aspects of the present invention.

DETAILED DESCRIPTION

[00020] Referring to Fig. 6, consider an imaginary horizontal plane (parallel to the ground plane) that is orthogonal to the plane containing the face centerline, and which contains a point X which is substantially on this centerline plane. The intersection of such an imaginary plane with the sole surface of a club head, designated Area 2, is a small area called the lowest point area LPA. For a golf club initially to contact the ground at point X rather than at a point LP on the downswing, any portion of the sole of the club head lower than point X should be removed, such that point X and no point lower than point X is the initial contact point of the club head with the ground during ball striking. Removal of such lower points may result in a lowest point area like LPA Area 2. While, as initially identified above, LPA Area 2 is planar, it need not necessarily be planar. And, while it is illustrated as elliptical or circular, it need not have that perimeter shape. And, it could be simply two or more points, a line or other surface area. Once any excess material has been removed in forming LPA Area 2, as generally described above, curvature, such as curvature similar to the sole radius, may be imparted to that area as desired, so long as no point in the LPA is

lower than point X which remains the initial contact point with the ground during ball striking with a club having such a club head.

[00021] Fig. 7 illustrates the sole of the club head in address position with the toe slightly elevated. An imaginary horizontal plane that is parallel to the ground plane and which contains the intersection point between the sole surface (Area 1) and the vertical line passing through the center of gravity, intersects the sole surface forming an Area 3. To minimize face to back offset with respect to the center of gravity of the club head, of the static point of contact SCP, and to prevent the club head from undesirably opening or closing at address, any portion of the sole of the club head lower than the static contact point SCP when the club head is in an address position should be removed. Such material is preferably removed so that the point of intersection between a substantially vertical line passing through the center of gravity and the sole surface is the static contact point SCP between the club head and the ground plane when the club is in an address position. Removal of such lower material may result in a static contact surface area SCA like Area 3. If SCA Area 3 is removed as described above, curvature also may be imparted thereto as desired, so long as the point of intersection between the

vertical line passing through the center of gravity and the sole surface remains the lowest static contact point SCP when the club head is in an address position. While the static contact area SCA is illustrated as elliptical in shape, it need not have that perimeter shape, and it could be simply two or more points, a line or other surface.

[00022] Thus, as indicated in Figs. 6 and 7, LPA Area 2 and SCA Area 3 will have bounce angles different from those of the sole surface Area 1. Those skilled in the art will appreciate that the bounce angle specified for Area 2 may be between zero and about 20 degrees. The bounce angle of each of LPA Area 2 and SCA Area 3 may vary with respect to the bounce angle specified for Area 1, by up to about 5 degrees. It will also be appreciated that the present invention may be facilitated by modifying sole width, sole radius, and/or sole camber in addition to or in lieu of modifying bounce angle. And, the specific topographies of each of LPA Area 2 and SCA Area 3 may be achieved by using a number of different manufacturing methods, including casting, machining, grinding, polishing, or any other method of appropriately shaping those specific areas of a club head.